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Overview of the Refractory Mineral Potential of Zambia

BERT DE WAELE[1]

Tectonic Special Research Center, School of Applied Geology, Curtin University of Technology, Hayman Road, Bentley, Western Australia, WA 6102, Australia

AND SIMASIKU SIMASIKU[2]

Geology Department, School of Mines, University of Zambia, P.O. Box 32379, Lusaka, Zambia

Abstract

This paper gives an overview of Zambia's potential in refractory minerals. Through the continued efforts of the Geological Survey of Zambia, and especially the former ZIMCO Ltd. mineral exploration wing (Minex Department), large parts of the country have been explored for mineral potential in the past. Exploration potential for small- to medium-scale deposits remains very favorable, with new deposits discovered annually. From the study it was determined that known refractory mineral potential includes the following minerals: silica raw materials, fireclay, alumina raw materials (kyanite, andalusite, sillimanite, and corundum), magnesia raw materials (magnesite), and forsterite raw materials (talc, pyrophyllite, serpentine asbestos). Other typical refractory minerals may be available but of poor grade, or in small, uneconomic deposits, or may as yet be undiscovered.

Introduction

INDUSTRIAL MINERALS, as opposed to base metals, gemstones, and precious metals, can provide a welcome additional source of foreign exchange earning for any developing nation. Zambia's foreign exchange earnings, as a leading copper producer, have long been predominantly based on its copper production. Because of falling copper prices worldwide, the need arises for Zambia to diversify its export market, both within the mining sector (which still accounts for about 70 percent of the foreign exchange earnings) and in other sectors such as energy, tourism, and agriculture. Zambia is endowed with a wealth of underutilized natural resources, of which industrial minerals are just one example.

Industrial minerals may find a place on the Zambian export market for a number of reasons: (1) the country has a large array of export-quality industrial minerals in economic quantities; (2) the extraction and benefication of industrial mineral deposits often only requires a relatively low capital investment, as compared to copper or precious stones/metals mining; (3) worldwide demand for specialized industrial minerals—such as refractory minerals, minerals for the cosmetics industry, and abrasives—would justify the promotion of small-scale mining activities in Zambia. This assistance could consist of soft loans and direct assistance to small-scale mining entrepreneurs; technical assistance in the field of mining exploration, mine planning and safety, marketing, and economic strategies; and through promoting Zambia's industrial mineral potential to the world.

Refractories are defined as materials having the ability to retain their physical shapes and chemical identities when subjected to high temperatures. They are resistant to corrosive solids, liquids, and gases at temperatures of greater than 1500°C. They are used to manufacture furnaces, driers, parts of jet engines, missiles, and spacecraft. Three types of refractories are distinguished based on their temperatures of fusion. Refractory minerals fuse between 1580°C and 1780°C, whereas high refractory minerals fuse between 1780°C and 2000°C and super refractory minerals at temperatures higher than 2000°C. Resistance to high temperatures is the primary requirement for refractory materials, but is by no means the sole requirement. Refractories must be able to withstand thermal shock, resulting from rapid heating or cooling, other stresses induced by temperature change, and mechanical wear (abrasion) resulting from movement of furnace content and pressures from the weights of furnace parts.

Refractories of many kinds are needed for a variety of industrial applications. Industrial-grade refractories are classified on the basis of composition and properties into a few main groups, namely

[1]Email: dewaeleb@lithos.curtin.edu.au
[2]Email: simasiku@mines.unza.zm

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